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Attitude Dynamics Simulation Subroutines for Systems of Hinge-Connected Rigid Bodies With Nonrigid Appendages

G. E. Fleischer

P. W. Likins

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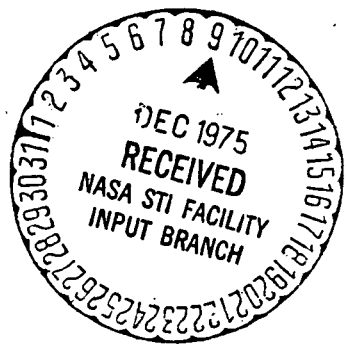

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Preface

The work described in this report was performed by the Guidance and Control Division of the Jet Propulsion Laboratory.

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Abstract

This report describes three computer subroutines designed to solve the vector-dyadic differential equations of rotational motion for systems that may be idealized as a collection of hinge-connected rigid bodies assembled in a tree topology, with an optional flexible appendage attached to each body. Deformations of the appendages are mathematically represented by modal coordinates and are assumed small. Within these constraints, the subroutines provide equation solutions for (1) the most general case of unrestricted hinge rotations, with appendage base bodies nominally rotating at a constant speed, (2) the case of unrestricted hinge rotations between rigid bodies, with the restriction that those rigid bodies carrying appendages are nominally nonspinning, and (3) the case of small hinge rotations and nominally nonrotating appendages, i.e., the linearized version of case 2. Sample problems and their solutions are presented to illustrate the utility of the computer programs. Complete listings and user instructions are included for these routines (written in Fortran), which are intended as general-purpose tools in the analysis and simulation of spacecraft and other complex electromechanical systems.